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BASIC Demonstration Programs-Tape #1

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DEC-E8-TXPA-D

BASIC DEMONSTRATION PROGRAMS

TAPE #1

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BASIC Demonstration Programs
Tape #1 (E 10 DEMO)

Program	Name	Description
1	CONVERGE	Program will calculate 1. e by infinite geometric series 2. π by inscribed and circumscribed polygons 3. π by infinite arithmetic series
2	ROOT FINDER	Program finds all the roots of any function between - 20 and + 20 "Newton's Method."
3	GOLDBACH	Calculates even numbers from 6 to 50 with two prime odd factors.
4	3DPLOT	Plots a three-dimensional, perspective graph showing a "family of curves" of any function.
5	EVOLU	Demonstrates the effect of genetic mutations of a sample of 10,000 pepper moths.
6	PHOTO-E	Simulates the bombarding of various metal plates with soft X-rays in vacuum chamber.
7	KINEMA	Tests student's knowledge about the velocity and acceleration of a ball thrown up into the air.
8	DEPRECIATE	Shows how capital equipment depreciates according to three methods: straight line, sum of years digits, and double declining.
9	PAY SCALE	Calculates teachers' pay scales for a school.
10	DECWRITER	Prints out "INTERACTIVE BASIC" in a sine wave.

DEMO PROGRAM #1 CONVERGE

OBJECT: To show the math teacher how EduSystem 10 allows him to better teach the material he is teaching by performing massive calculations quickly.

DESCRIPTION: The CONVERGE program will calculate:

1) e by infinite geometric series
2) π by inscribed and circumscribed polygons
3) π by infinite arithmetic series

These methods are commonly taught, but rare is the student who has gained experience in them by actually calculating them.

USAGE: Load CONVERGE and type RUN. The program asks which calculation you want. Type N if you don't want to do that one; type Y if you do. The program types until stopped by the 'S' key.

Important Note: When π is being calculated by infinite series, the program types out only every 500th value. Thus, each value typed out corresponds to 8 pages of typeout, which would be produced if each step in the approximation were typed.

LIMITATIONS: Requires that SIN and COS be loaded. Runs with all but ATN loaded.

EDUCATIONAL BENEFITS: The most important lesson that the student learns is the relative swiftness with which these approximations converge. The first two, which are geometric series, draw the bead very quickly. The third is very slow, even at computer speeds. After 2 1/2 hours (and 500,000 iterations) it is still working on the 5th decimal place. This slowness demonstrates the difference between a convergence based on an arithmetic progression and one based on a geometric progression.

OTHER EXAMPLES: There are many examples where EduSystem 10 brings concepts to life which are otherwise buried under endless calculations. e.g.

1) integration by Simpson's rule
2) compound interest
3) calculations based on many random numbers

DEMO PROGRAM #2 ROOT FINDER

OBJECT: To show the math teacher how EduSystem 10 allows him to teach material that is impossible to teach without the computer.

DESCRIPTION: ROOT finds all the roots of a function (ANY FUNCTION!) between -20 and 20. The function may be quadratic, cubic, trigonometric or any combination. Algebra 1 students learn how to solve linear and quadratic equations, but for most students, this is the limit of their capabilities. The method used here involves evaluating the function at incremental values, finding places where the value of the function changes sign and then, by successive approximations, finding the zero point.

USAGE: Type SCRATCH to delete any previous program, then load ROOT. Before typing RUN, enter the function to be evaluated as a DEF FNA (X) statement as line 100. Then type RUN. For example:

```
100 DEF FNA(X) = 2*X↑3+11*X↑2-31*X-180

100 DEF FNA(X) = SIN(X)-.5

100 DEF FNA(X) = X-4
```

LIMITATIONS: Requires that the DEF function be available plus any functions which are used in the DEF statement itself. Runs with all functions but ATN loaded. The program is coded to look for solutions only between -20 and 20. It could just as easily look at any other interval.

EDUCATIONAL BENEFITS: The average student (especially in high school) does not have a thorough understanding of the very important concept of solving a function, much less an ability to do so for functions of any complexity. The computer lets them become very knowledgeable and confident in this area. In fact, at Lexington (Mass.) High School, freshmen algebra students are expected to be able to solve any function. Only the availability of a computer makes this level of learning possible.

DEMO PROGRAM #3 GOLDBACH

OBJECT: To show how the computer can be used as a learning tool in math. More important, to show how EduSystem 10 may be used in conjunction with the new series of math texts now becoming available. This program and the descriptions below are taken from Chapter 25 of CAMP's First Course book.

DESCRIPTION: This is the description of the program exercise as it appears in the CAMP text (page 200).

"Goldbach's Conjecture is one of the famous unproved theories in mathematics. Many people have searched for a counter-example to prove that the following claim is false: Every even number E greater than four is the sum of two odd prime numbers. Study the program "Goldbach" which will print out each even number E, where $E \leq 6 \leq 50$, and two odd prime numbers whose sum is E. Examine the output from the computer. Does this program "prove" the conjecture.

The teacher's guide is quick to point out that it proves the conjecture for $E \leq 50$, but that's all.

USAGE: Load Goldbach and type RUN. No input is required.

LIMITATIONS: Uses no functions. Runs with all but ATN loaded. Slow. This program has nested loops which take time. Running time is in minutes.

EDUCATIONAL BENEFITS: The student has whole new ways to approach theorem proving when the computer is available to try lots of cases.

The important point about this program is that it demonstrates the connection between EduSystem 10 and the CAMP text. Each supports the other.

DEMO PROGRAM #4 3DPLOT

OBJECT: To show the power of the computer for plotting visualizing physical phenomena.

DESCRIPTION: 3DPLOT will plot a three dimensional, perspective graph of a function of three variables. It plots Z (the vertical axis) as a function of X and Y, where X and Y are inside a circle of radius 30.

USAGE: Type SCRATCH, then load the program. Enter the function to be plotted as a DEF FNA (Z) statement in line 5. Then type RUN. The resulting plot will go sideways on the page.

LIMITATIONS: Requires that SQR be loaded plus any functions used in the DEF. Runs with all functions but ATN loaded. Like all plotting programs, some functions come out "prettier" than others. Several that are known to work are:

```
5 DEF FNA (Z) = 30*EXP(-Z*Z/100)
5 DEF FNA (Z) = SQR (900.01-Z*Z)*.9 -2
5 DEF FNA (Z) = 30*(COS(Z/16))↑Z
5 DEF FNA (Z) = 30-30*SIN(Z/18)
5 DEF FNA (Z) = 30*EXP(-COS(Z/16)) -30
  (Bessel function - Summerfeld's Integral)
5 DEF FNA (Z) = 30*SIN(Z/10)
```

The constants are factors to make the plot come out within the limits.

EDUCATIONAL BENEFITS: Using the computer to plot is an excellent way to teach coordinate geometry.

OTHER EXAMPLES: EduSystem 10 can, of course, also do the more routine forms of 2-dimensional plotting.

DEMO PROGRAM #5 EVOLU

OBJECT: To show the science teacher how EduSystem 10 can simulate a lab experiment which would take too long to do in real life or allow the student to control parameters which he couldn't control in real life.

DESCRIPTION: The EVOLU program demonstrates the effects of genetic mutations of a sample of 10000 pepper moths. These mutations cause a small number of these moths to become somewhat light in tone. However, it takes many years for this effect to show up, making it impossible to show in a school lab. In addition, the program allows the student to vary the mutation rate and to change the environment midway in the experiment.

USAGE: Type SCRATCH to delete any previous program, then load EVOLU. Type RUN. When asked, enter the mutation rate (from 1 to 10), the year in which the environment is to change (3 to 10) and whether the environmental change will favor light (type an L) or dark ones (type a D). The program then prints out the course of evolution over a thirty year period.

LIMITATIONS: Will run with all but ATN loaded. Gives unpredictable results if the input values are not within the limits described in the section on usage.

EDUCATIONAL BENEFITS: Where else can a student observe a thirty year reproductive cycle and watch the effects of mutations? More important, where else can the student repeat the cycle, trying new parameters and conditions?

This experiment illustrates the computer's ability to answer the vital question: "What if?" In a regular lab, the student barely has time to run through an experiment once. At the end he may ask "Supposing I had changed one parameter?" Without the computer, he either runs the experiment again or forgets the whole thing. The computer answers the "What if?" question immediately.

OTHER EXAMPLES: Many other science experiments take a long time to run, or require several runs. They may often be simulated on the computer.

DEMO PROGRAM #6 PHOTO-ELECTRIC EFFECT

OBJECT: To show how the computer may be used to "simulate" expensive laboratory equipment. To show that the computer lets the physics teacher do more lab work at lower cost.

DESCRIPTION: When light of short wave-length falls on a metal surface, electrons are ejected from the metal. According to the description of this phenomenon by Einstein, there is a maximum wave length for each metal above which no electrons are emitted. This program lets the user find this critical wave-length.

USAGE: The program simulates the actual experiment, where the metal is placed in a vacuum and bombarded with soft X-rays. The number of electrons ejected is collected and counted by means of an ammeter. The program types out three ammeter readings for each wave-length. After this has been done, the intensity may be increased and the experiment rerun. The typed out values could then be graphed to show the critical wave-length.

To pick a metal enter its coefficient as follows:

Silver	.308
Bismuth	.338
Cadmium	.318
Lead	.340
Platinum	.385

LIMITATIONS: Requires that the SQR function be loaded. Runs with all functions but ATN loaded.

EDUCATIONAL BENEFITS: Students very rarely get to work with the same concepts that Einstein worked with, or indeed with any of the great 20th century work in physics. The reason is simple: modern physics uses laboratory gear that is way beyond the means of most schools. The concepts themselves are often easy enough for the student; it is only the lack of equipment that holds him down. The computer can fill this gap by simulating equipment. A computer does all kinds of things all year long. Its flexibility means it is never idle.

DEMO PROGRAM #7 KINEMA

OBJECT:

1) To show how EduSystem 10 may be used in physical science courses, as well as mathematics.

2) To show the usefulness of the computer as a motivation and reinforcement tool in traditional courses and curricula.

DESCRIPTION:

The KINEMA program tests the student's knowledge of kinematics. A ball, or any other object, is thrown up at a certain velocity (in meters per second.) The student is then asked to calculate certain information about the resulting trajectory. The computer then checks the response to see if it is within 15%.

USAGE:

Load KINEMA, then type RUN. Then try to answer the questions. Distances should be entered in meters, time in seconds, and velocity in meters per second (plus for up, minus for down.) Type the 'S' key to terminate.

LIMITATIONS:

Requires that the random number function be available. Runs with all functions but ATN loaded.

EDUCATIONAL BENEFIT:

The key educational benefit here is the powerful motivating force that the computer has. The work that the student is being asked to do is really no different than rote homework exercises. But the computer makes it a challenge. It is very frustrating to have a dumb computer keep telling you you're wrong. Try it yourself and see if it doesn't make you want to brush up on your physics. That's real motivation.

OTHER EXAMPLES:

EduSystem 10 can provide this type of reinforcement and drill for a wide variety of subjects, from simple number facts on up.

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OTHER EXAMPLES: EduSystem 10 can provide this type of reinforcement and drill for a wide variety of subjects, from simple number facts on up.

DEMO PROGRAM #8 DEPRECIATE

OBJECT:	To show how the computer may be used in the business department.
DESCRIPTION:	This program shows how a piece of capital equipment depreciates according to three commonly used depreciation methods: straight line, sum of the digits, and double declining.
USAGE:	Load the DEPRECIATE program and type RUN. Enter the purchase price of the item, its life in years, and its scrap value at the end of that time.
LIMITATIONS:	Uses no functions. Runs with all but ATN loaded.
EDUCATIONAL BENEFITS:	The study of "general business" is often just the study of a lot of tables in a textbook. It's hard for a student to get involved in this work, since he often doesn't understand what is behind these tables. The computer can bring many of these topics to life. Also, by having some exposure to a computer, the student learns to be comfortable with it. He will be much better prepared for work in a modern business.

DEMO PROGRAM #9 PAY-SCALE

OBJECT:	To show the computer doing something of direct interest to the teacher and administrator himself.
DESCRIPTION:	Pay-Scale calculates the pay scale for a school. The user may vary the inputs and then see the actual pay scale that results.
USAGE:	Load PAY-SCALE, then type RUN and answer the series of questions. The program then types out the pay scale.
LIMITATIONS:	Does not require any functions. Runs with all but ATN loaded.
EDUCATIONAL BENEFITS:	Not really. This program relates more to school operation than to curriculum. It is, however, a good, straight-forward example of a BASIC program which might be used to illustrate how easy it is to program in BASIC.

DEMO PROGRAM #10 DECWRITER

OBJECT:	To provide an interesting typeout pattern which can run continuously when the computer is not actually being used.
DESCRIPTION:	DECWRITER prints out INTERACTIVE BASIC in a continuous sine wave. Inside each wave the DEC initials are typed out.
USAGE:	Load DECWRITER, then type RUN. The program will run until stopped by typing the S key.
LIMITATIONS:	Requires that the SIN function be loaded. Runs with all functions but ATN loaded. Uses multiple statements per line.